

	SURFACE VEHICLE STANDARD	SAE J2495 FEB2011
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Thermal Containment Efficiency of Sleeve Materials		

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1. **Scope**—This SAE Standard measures the percent thermal efficiency of materials in sleeve form used to contain heat or insulate around a hot component. The percent thermal efficiency (%TE) is determined by measuring the power difference expended by the heat source (cartridge heater) with and without the test sleeve at the specified temperature. See SAE J2302 to measure radiant heat flow of sleeves.
- 1.1 **Safety**—This method may involve hazardous materials, operations and equipment. This document does not address the safety concerns associated with its use. It is the responsibility of the user of this document to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.
- 1.2 **Limitations**—The temperature measurement range of this procedure is 260 °C to 700 °C. Sleeve size is limited to 19 mm ± 2 mm ID and 280 to 300 mm long. This procedure is performed under static (passive) air flow with no vibration. Do not adapt the temperature sequencing as a thermal cycle.
- 1.3 This test method is based on SI units per IEEE/ASTM SI 10.
- 1.4 **Note to Users**—Use the appropriate alpha-numeric codes to specify temperature condition (Table 1), sequence (Table 2), smoke generation option (see 6.3.2) and auxiliary thermocouple location(s) (position and distance) when referencing this document. For example, a line code of B(2)P(12)D(10,23) after the SAE document number means: Heating to a step sequence (B2), first at 260 °C, then 427 °C measuring power. The auxiliary thermocouple position (P) is at 12 o'clock, on the sleeve surface in two locations, 100 mm and 230 mm from the cartridge heater flange to the end. Bracket all numbers in parenthesis.

2. References

- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.
 - 2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J2302—Thermal Effectiveness of Sleeve Insulation
 - 2.1.2 IEEE/ASTM—Available from American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

IEEE/ASTM SI 10-1997—Standard for Use of the International System of Units (SI): The Modern Metric System

2.1.3 NBS PUBLICATION—National Institute of Standards and Technology, U. S. Department of Commerce, Gaithersburg, MD 20899.

NBS Circular 590—Methods of Testing Thermocouples and Thermocouple Materials

3. **Summary**—This document describes the method and equipment for measuring the effectiveness of sleeves required to contain heat. The test also contains the option of monitoring smoke generation time at the conditions specified (see item 6.3.2). A base line is established first by exposing a 338 mm long x 16 mm OD, cartridge heater assembly (w. thermocouple) to the specified temperature. The controlling thermocouple is mounted at the midpoint and top surface of the cartridge heater. During the test, four power readings of the cartridge heater are recorded, one every 15 min after the tube reaches thermal equilibrium. After establishing the base line power readings, the cartridge heater is sleeved with the thermocoupled protective material and tested again. The surface temperature of the sleeve is recorded. There is no need to measure the cartridge surface temperature, since the heater surface temperature is controlled by the source temperature setting. At the operator's discretion, auxiliary thermocouples mounted at points along the sleeve surface monitor additional sleeve temperatures. In both test sequences, measuring the power expended by the heater, along with the heat source temperature and sleeve surface temperatures assures consistent and fair measure of the sleeve's effectiveness. Only the ratio of power unsleeved less the power sleeved, divided by the unsleeved power expressed as a percent, determines a sleeve's thermal efficiency. A significant variation in these values requires repetition of the test sequence.

4. **Significance and Use**

- 4.1 Data obtained by this method are applicable to the material under conditions of this test and are not necessarily the same as those obtained in end use applications. The information permits comparison, selection, or qualification of commercially available sleeves where a level of proficiency is desired beyond short time quality control tests.
- 4.2 The test set-up (see Figure 1) accommodates one test sleeve and relevant thermocouples. Indicate other thermocouple positions and distances from the cartridge heater using item 6.3.3 protocol.

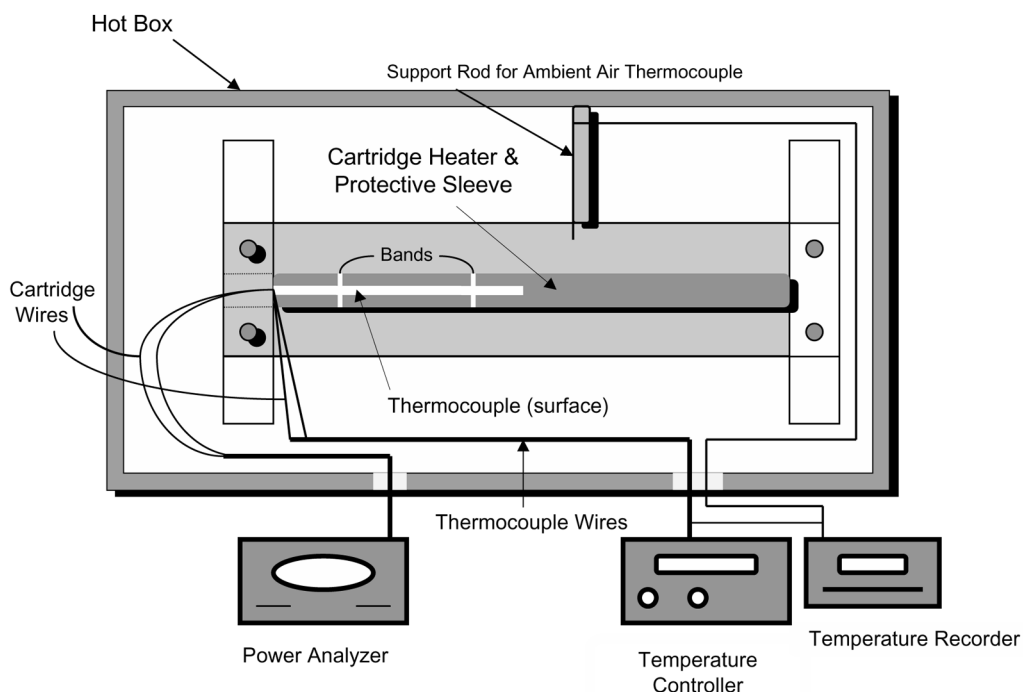


FIGURE 1—TEST SET-UP, TOP VIEW

- 4.3** Test conditions and requirements using a line code must follow the order of temperature, sequence, and thermocouple position designated by the numbers on a clock. See item 1.4. Bracket all numbers in parenthesis.
- 4.3.1** TEMPERATURE AND SEQUENCE PROTOCOL—List single or multiple test temperatures using the appropriate Table 1 condition letter. Condition A cannot use the sequence number 2 or 3 because it is the lowest specified temperature. If a step sequence is desired with Condition A as the upper temperature, use the Z suffix. Using a 2 or 3 test sequence after a B or C condition means the sequence follows the lower temperatures in Table 1. Always use the Z suffix to indicate a departure from the Table 1 temperature sequence. When using the Z suffix, indicate the preferred temperature's in degrees centigrade in parenthesis, separating the temperature's with a slash mark (/) - for example Z2 (100 °C/121 °C).
- 4.3.2** POSITION PROTOCOL—The letter P, followed by the appropriate number in parenthesis, indicates the circumferential clock position of the auxiliary thermocouple(s) on the surface of the cartridge heater and/or sleeve. If no specified position is stated, no measurement is made. Twelve is at the top surface with numbers proceeding clockwise as observed from the tip end (opposite the wires) of the cartridge heater.

5. Equipment¹

- 5.1 Hot Box**—Fabricated from non-conductive, fire resistant, thermal insulation board material², 50 mm x 610 mm x 1220 mm, open at the top with nominal internal dimensions of 500 mm x 500 mm x 500 mm. Angle iron 50 mm x 50 mm x 4 mm supports the box panels (6000 mm total). See detail drawing Figures 2A and 2B.

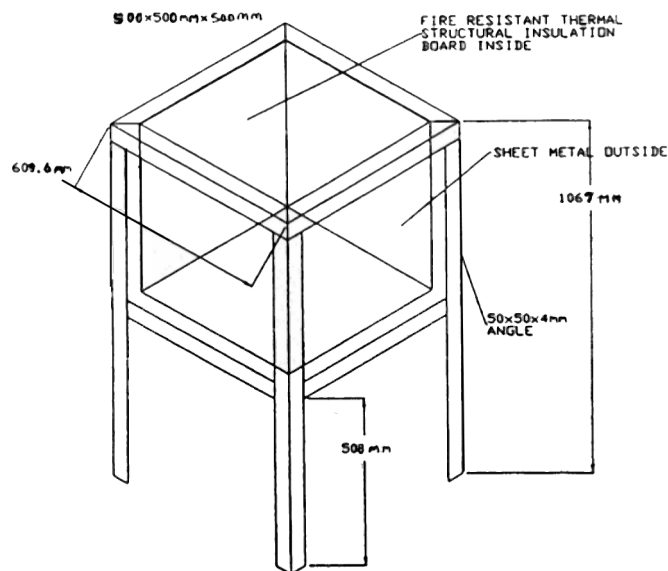


FIGURE 2A—HOT BOX

1. All are single items, except as indicated.
 2. (McMaster Carr 93371K67 or equivalent meets the requirements.)